Fluid-Sediment Interactions in the Nearshore

Daniel C. Conley
Marine Sciences Research Center
State University of New York, Stony Brook
Stony Brook, NY. 11794-5000
telephone: (516) 632-9251
fax: (516) 632-8820
email: dcc@goased.msrc.sunysb.edu
Award #: N00014-98-1-0007

LONG-TERM GOALS

The long range goal of this research is to build the knowledge base necessary to paramaterize small scale processes of coastal sediment transport for inclusion in morphological models of larger scale coastal behavior.

OBJECTIVES

The immediate objectives of this project are to examine the importance of various time and space scales of sediment transport in the context of morphology change. In particular, this research will attempt to partition sediment transport into compartments of different temporal scales and to examine how this partitioning varies as a function of incident forcing, location within the surf zone and vertical position.

APPROACH

The vertical distribution of sediment flux will be estimated over a 2-dimensional grid which spans the surf-zone. These flux estimates will be derived from sediment concentration and fluid velocity measurements recorded from stacks of fiber-optic back scatter sensors (FOBS) collocated with vertical arrays of electro-magnetic current meters (VEMA). The frequency distribution of sediment flux will be determined from the cross-spectra of concentration and velocity and the flux will be partitioned into mean, incident and infra-gravity components. This information will be examined to identify the relative importance of these components as a function of surf zone location and fluid forcing as well as to determine the importance of the divergence of these components on morphologic evolution.

The measurements were collected as part of the Sandy Duck surf zone experiment which occurred at the USACOE Field Research Facility at Duck, North Carolina during September and October of 1997. The wide range of conditions encountered in the 2 months of data collection will permit the examination of how these results vary with changing incident wave conditions, differing bottom morphologies and varying water depths.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
1998		**00-00-1998 to 00-00-1998**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Fluid-Sediment Interactions in the Nearshore	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **State University of New York, Stony Brook,Marine Sciences Research Center,Stony Brook,NY,11794-5000**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM002252.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**3**	

WORK COMPLETED

The field work and data collection portion of the project has been completed. The 16 Hz. field data has been examined for data quality, decimated to 2Hz. and archived in 8 separate databases representing approximately 5 Gigabytes of data. Pressure, velocity and concentration measurements are available 24 hours/day at 9 locations with 5 in the longshore and 5 in the cross-shore. Gross data processing has been completed with all concentration records plotted and bulk velocity properties determined for each data run. Agregate plots of concentration measurements have been created which facilitate the identification of periods of strong bed erosion or deposition. Current meter records have been tested to determine proper sensor alignment and appropriate corrections have been applied to the data.

RESULTS

In the two month data set, 5 major erosion/deposition events were identified where over 10 cm. of deposition or erosion occurred throughout the array with maximum bottom alteration of as much as 50 cm. Two patterns of bottom change occur, one where bottom movement occurs as a gradual continuous process and a second where net bottom movement is hidden in a series of relatively rapid oscillations of the bottom (Figure 1).

Profiles of sediment flux during the largest storm of the experiment indicate that, at most locations, the mean component of sediment transport predominates. The second largest constituent appears to be the infragravity contribution. Near the shoreline this component shows interesting behavior in which the transport direction is offshore through much of the water column but reverses direction near the bed where the largest flux occurs.

IMPACT/APPLICATIONS

A large, high quality, data set of sediment concentration and fluid velocity has been collected in a variety of conditions throughout the surf zone. Initial analysis shows that the data covers periods of both coastal erosion and beach recovery so the questions relating to all phases of morphological development can be addressed. Preliminary results indicate that there is significant vertical structure in the patterns of sediment flux and that individual components of flux may experience reversals of direction with height above the bed.

TRANSITIONS

The data from this project has been collected and is being used in conjunction with Dick Sternberg and Andrea Ogston (U. Wash.) and Reg. Beach (ONR).

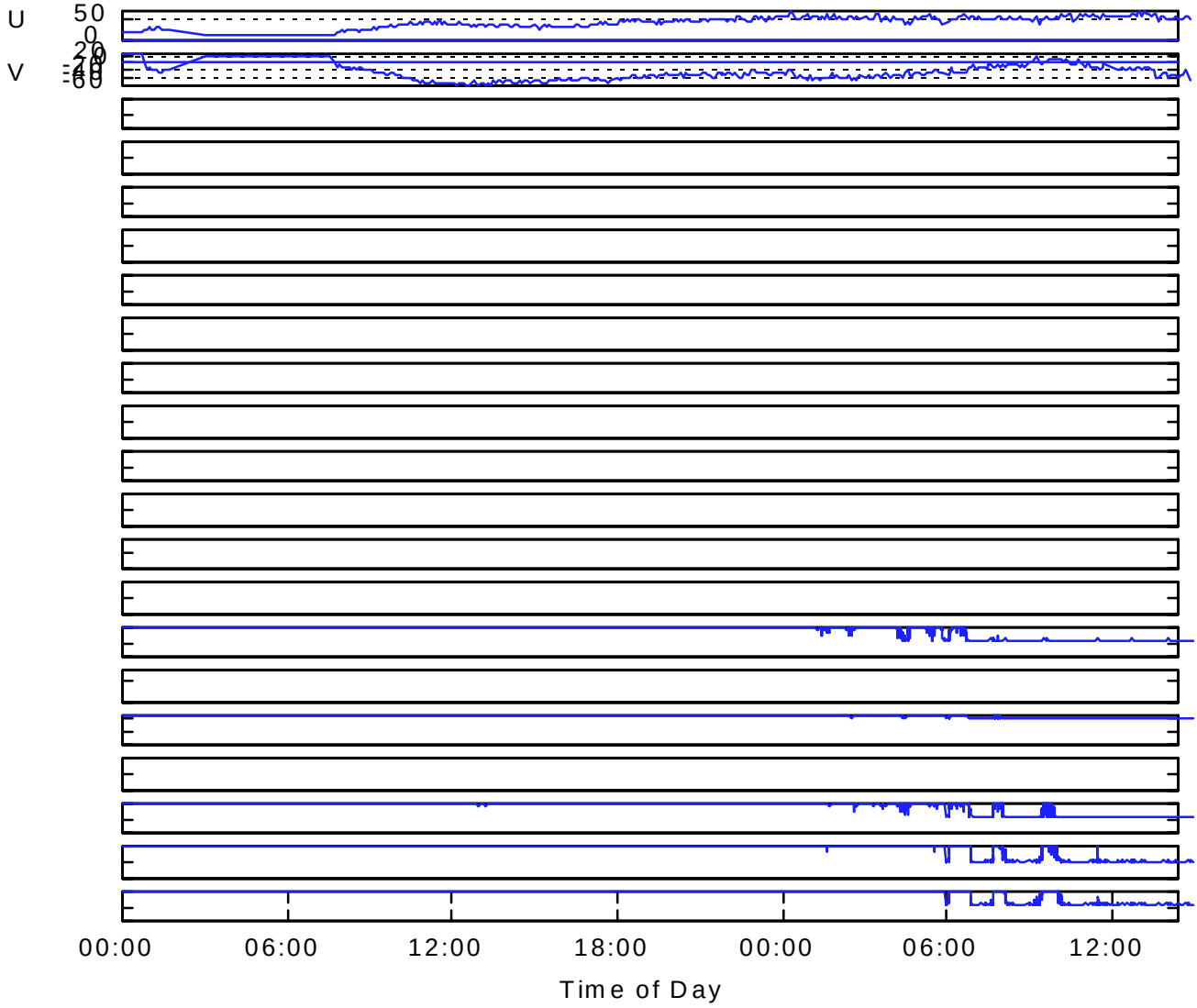

Figure 1: Time series of mean crosshore (u) and longshore (v) velocity and 19 channels of raw concentration measurements at site for the 19th and 20th of October 1997. FOBS is saturated when buried so bed level is near top of quiescent channels. Figure shows approximately 50 cm of erosion over a 36 hour period. Erosion starts off as a steady gradual lowering of the bed followed by a period of rapid bed oscillations.

RELATED PROJECTS

See above.